

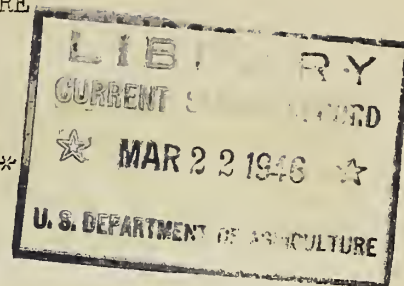
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UNITED STATES DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICESummary Review of Monthly Reports\*  
for  
SOIL CONSERVATION SERVICE RESEARCH\*\*

DECEMBER 1945

EROSION CONTROL PRACTICES DIVISION

Conservation Profitable But Requires Investment - E. L. Sauer,  
Urbana, Illinois.-"Excerpts from a radio discussion of conservation farming  
in Madison and St. Clair counties in Illinois are as follows:

"Twenty percent more farmers were contour farming in Madison and St. Clair  
counties in 1945 than in the previous year.

"Conservation farms had less of their land in intertilled crops (corn and soy-  
beans) and in small grains and more in legumes and grasses than the noncon-  
servation farms. They had 35 percent of their cropland in soil improving  
legumes and grasses compared to 28 percent on the nonconservation group. Crop  
yields were 8 percent higher on the conservation farms, and as a result they  
produced almost as much grain as the nonconservation farms and in addition  
produced 25 percent more hay and grasses. As a result, these conservation  
farms were able to keep 2.5 more milk cows per farm and their improved legume  
and grass hay and pasture helped to account for 24 percent more milk produc-  
tion per cow. The farms in both groups were approximately 200 acres in size.  
More beef and sheep were also raised on the conservation farms.

"The conservation program added up to an increase in net income per acre of  
\$4.79 in 1944. The following of a complete plan of conservation operations,  
plus the efficient use of the legumes and grasses through livestock was worth  
\$766 above the nonconserving system of farming on the equivalent of a 160-  
acre farm in 1944.

"Assuming the needed application of 3 tons of limestone and 1000 pounds of  
rock phosphate per acre, plus the possible need for potash, drainage, or ter-  
racing the adoption of a conservation program may easily cost \$20 or more per  
acre, plus the time needed to get the program in operation.

"While many farmers may feel that they cannot afford to adopt conservation  
methods of farming, they really cannot afford not to adopt a soil improvement  
and conservation system of farming. While it may take 4 to 6 years of bene-  
fits to pay for the costs of a conservation program, those who do not adopt  
such a program will find that their earnings will steadily decline while the  
others steadily increase. Farm records show that the spread in earnings be-  
tween good and poor farming is steadily becoming wider.

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tion without permission from the Washington Office, Soil Conservation Ser-  
vice Research.

\*\*All Research work of the Soil Conservation Service is in cooperation with  
the various State Experiment Stations.

"The major limiting factor to getting more conservation on the land is capital. Farm records show that, at present price levels, conservation farming can be made to pay over a ten-year period \$45 an acre above nonconservation farming. Credit agencies should make every effort to see that the lack of capital is no longer a limiting factor to soil conservation and improvement."

Storm Damage in California - "Rip" or "Subsoil"? - Maurice Donnelly, Riverside, California.-"Just before Christmas 1945, general storms over southern California brought from 4 to 6 inches of rain on most of the lowlands. The rate of fall was remarkably low. At Somis, California, the highest intensity recorded was 0.5 inch in 50 minutes and, for most of the fall, rates did not exceed 0.2 of an inch per hour at that location.

"Despite the low rainfall intensities, much cultivated land was damaged, especially seeded grain field. Previous rains were not sufficient, in many cases, to bring the grain up to the point when the plants furnished protection. On the steeper cultivated fields, the soil became so saturated that soil movement approaching mud flow took place. In grain fields where a claypan underlies 12 to 24 inches of top soil, the top soil after the rain was like mud, and pretty thin mud at that, from the surface to the top of the claypan.

"The storm brought out two interesting points concerning the experiments at Somis, California, on lima-bean fields:

1. "We have been comparing the erosion-control usefulness of contour ripping versus contour subsoiling. The two types of tillage are much alike and are performed by dragging a heavy chisel or subsoil blade through the soil along a contour line. In ripping, the depth of penetration of the soil ranges from 7 to 10 inches, whereas, in subsoiling depths of from 12 to 16 inches are reached. Since the power requirements for subsoiling are much higher than those for ripping, operators wish to know whether the extra cost is justified.

During the December 1945 storm, soil was moved from ripped fields at a rate (estimated) of 25 tons per acre. Subsoiled fields showed no soil removal. The subsoiled fields also were in such condition at the end of the storm that they could have absorbed considerable additional rainfall without damage.

2. "In the 2-year rotation of lima beans and grain hay, a summer weed comes into the grain-hay fields after hay harvest. The question is--should this weed be destroyed by tillage during summer? If it is destroyed, much of the hay stubble is necessarily turned under. By leaving the weed dry up, as it does in the fall, additional organic residue is at the surface to control winter rains. On hay stubble fields where this weed had not been turned under and where light subsoiling was done in the fall, rainfall in the December 1945 storm was totally absorbed and a remarkably high infiltration capacity still existed on these fields at the close of the storm. Unless an unforeseen biotic effect develops (such as increase in wire worms), it would seem to be better to leave the weed untouched during the summer and to utilize it as stubble mulch during the winter."



Lower Wheat Yields on Sub-tilled Plots - C. J. Whitfield, Amarillo, Texas.-"During 1944-45, wheat yields on stubble mulch field trials showed 7.9 bushels for the subtilled plots and 10.0 bushels for the check. There were little or no differences in soil moisture or nitrates under the different treatments.

Cattle Gains on Wheat Pasture and Dry Grass.-"Hereford steer calves, grazing wheat pasture supplemented with roughage and light feeding of cottonseed cake, made an average daily gain of 1.8 pound per head during the 54 day period from November 8 to January 1. The average weight on January 1, 1946 was 544 pounds per head.

"Steer calves, grazing dry grass supplemented with cottonseed cake, show an average daily gain of .90 pound per head for the same period. The average weight on January 1 was 496 pounds per head. However, the average daily gain for this group for December (31 days) was 1.10 pound per head.

"Ten head of coming 2-year old steers carried over, grazing wheat pasture, roughage, and light amount of cake, for December (31 days) show an average daily gain of 1.82 pound per head. Average weight, on January 1, 1946 was 1,043 pounds.

"Ten head of coming 2-year old steers, being wintered on grass and cake, show an average daily gain of .58 pound per head with an average weight of 964 pounds on January 1.

"Dry weather has prohibited grazing wheat pasture the greater part of December; thus, a goodly portion of the feeds have been ground sorghum bundles, cake and grass. Wheat pasture may be grazed immediately when it receives a light amount of moisture."

November Moisture and Next Years Forage - Oscar K. Barnes, Laramie, Wyoming.-"The fall soil moisture content of the range in relation to the following seasons forage production is shown in the accompanying table. Precipitation data for the years covered by this soil moisture study are also included.

"The use of such data as a basis for predicting forage production with any given amount of rainfall the following year is beginning to show some pattern. For example, the soil moisture in the fall of 1942 was high, the growing season precipitation during 1943 was below average, yet the forage production in 1943 was above average. In the fall of 1944 the soil moisture on the range was below average, the 1945 growing season precipitation was above average, yet the forage production for 1945 was below the average.

"Using a factor averaged for the past 6 years with the soil moisture content this past fall, it might be said that with average growing season precipitation we could expect 605 pounds of forage per acre of range in 1946. A longer record should be kept of the soil moisture, precipitation and forage production before making estimates, but the above illustrates what might be done in time. The same type of information as reported here has been collected from 3 other locations scattered across eastern Wyoming."

Fall Soil Moisture, Precipitation and Range  
Forage Production, Archer, Wyoming 1939-45

Production year	Soil moisture 1/ previous Nov. 1	Precipitation April-July	Range forage	Previous Precipitation	
	<u>Per Cent</u>	<u>Inches</u>	<u>Lbs. per acre</u>	<u>Aug.-Oct.</u>	<u>Nov.-March</u>
1939		4.28	47		
1940	5.71	6.42	268	2.01	2.11
1941	7.66	14.13	1213	4.86	2.48
1942	7.14	12.80	826	3.87	1.94
1943	12.33	9.86	759	6.50	2.18
1944	7.00	11.29	500	2.08	2.48
1945	6.40	11.17	471	.57	1.61
1946	7.78				
Average 1940-45	7.70	10.94	673	3.59	2.13

1/ Per cent of average of top three feet.

Corn Yields From Crop Residue Experiments, Marcellus - John Lamb, Jr., Ithaca, New York.-"Grain yields from the crop-residue experiment were adjusted to the basis of 56-pound bushel of shelled corn at 12-1/2 per cent moisture and are as follows:

Treatment	Turn-plowed seedbed	Disked seedbed	Sub-surface plowed seedbed
	<u>Bu./Acre</u>	<u>Bu./acre</u>	<u>Bu./Acre</u>
Manure plus 0-20-0	47.7	29.4	25.0
10-10-10 at 800 pounds per acre plus 4-12-8 at 300 pounds per acre	41.2	37.7	33.1
4-12-8 at 300 pounds per acre	34.9	28.6	24.0

"Difference required for significance is 7.2 bushels per acre. The yield with manure plus 0-20-0 fertilization was significantly greater than with other fertilization treatments. Likewise the yield with sub-surface plowed seedbed was significantly less than with other methods of preparing seedbed."

Highest Yield From Listed Corn - R. A. Norton, Ames, Iowa.-"The results of tillage studies on one farm about 42 miles from Ames are shown below. The field on which these plots were located had been well managed and was in a high state of fertility. It is believed this accounts for the reduction in yields on the fertilized plots under certain of the tillage treatments favoring thorough aeration of the soil. Apparently the fertilizer additions at planting time caused over-stimulation of the young plants. Later in the season they were unable to withstand adverse weather conditions and a reduction of yield resulted.

Tests of Primary Tillage Methods for Corn on Tama Silt Loam, Jasper County, Iowa, 1945

Tillage Methods	Joe Cross Farm			
	Without Commercial Fertilizer		167 lb. 3-12-12 per acre	
	Yield Bu./A	Stand Plants/A	Yield Bu./A	Stand Plants/A
Plowing	53.8	10,560	51.5	10,250
Loose-ground listing*	64.2	11,000	58.6	10,960
Hard-ground listing	59.7	10,930	58.6	11,090
Offset disking	53.1	9,770	53.1	10,840
Subsurface tillage	49.5	10,570	54.5	9,310
Subsurface tillage and offset disking	49.0	8,430	58.7	10,420

\*Preliminary preparation of land before loose-ground listing was by means of the subsurface tiller at about 3 inches, offset disk, and then the subsurface tiller at about 5-6 inches.

"These data represent the average of triplicate plots. The plots were in Red Clover and Timothy in 1944 and pastured in the spring of 1945. The average slope of plots was about 4 per cent. From 25 to 50 per cent of the topsoil had been lost through erosion."

Crop Yields and Soil Loss by Cover and Crop Sequence - J. B. Pope, Tyler, Texas.-"Cumulative effects of different crops and cropping systems on surface runoff, soil loss and crop yield in 1945 are shown below. The total rainfall in 1945 amounted to 54.76 inches. The 3-year rotation is corn, cotton, and oats with vetch cover crop following corn and preceding cotton. Oats follow cotton in the system. This study has been in progress since 1940 and the differences represent cumulative effects of the different crops and cropping systems over a period of 6 years on 1/50 acre control plots with replicated treatments."



Cropping System	Surface Runoff		Soil Loss Per Acre	Crop Yield Per Acre
	Inches	Percent	Tons	
Corn-no cover crop	9.40	17.2	10.88	27.8 bu.
Corn-oat cover crop	12.54	22.9	16.71	31.8 bu.
Corn in 3-yr. rotation	12.21	22.3	11.59	38.2 bu.
Cotton-no cover crop	14.74	26.9	5.79	282 lb. seed cotton
Cotton-vetch cover crop	15.37	28.1	9.60	368 lb. seed cotton
Cotton in 3-yr. rotation	8.75	16.0	4.05	435 lb. seed cotton
Oats	7.40	13.5	.83	16.5 bu.
Oats in 3-yr. rotation	9.53	17.4	1.43	39.9 bu.
Corn, cotton, and oats in 3-yr. rotation-Av.	10.16	18.6	5.69	

"Peach Orchard Soil Management" - Earl B. Kinter, State College, Pennsylvania.-Pennsylvania Agricultural Experiment Station Bulletin 476 with the above title and written by Charles O. Dunbar, R. D. Anthony and Earl B. Kinter is now available. It describes the results of experimental work at the Arendtsville Fruit Research Laboratory in Southern Pennsylvania.

Some of the conclusions with respect to cultivation and the use of cover crops are as follows:

"Late summer- or fall-seeded annual covers such as rye, ryegrass, and especially such legumes as crimson clover and vetch, which make their growth in the fall and spring and maintain a green cover during the winter can be managed by cultivation in late May or early June and again in July, so as to maintain the fertility of the soil without seriously checking the productivity of the peach trees.

"On the deeper soils, which furnish a larger reservoir of soil moisture, heavier covers can be grown and less cultivation given than on shallow soils, with less risk of checking tree growth, provided the supplementary applications of nitrogenous fertilizer are efficiently managed."

More Sweet Corn and Potatoes on the Contour - O. R. Neal, New Brunswick, New Jersey.-"Crop yields not previously reported include the results from a study of the effect of contouring on the yield of sweet corn and of potatoes. Where the soil, slope, fertilizer application, and other factors were equal, sweet corn with rows up and down slope yielded 7250 ears per acre while the yield from contoured rows was 9620 ears per acre. Potatoes with rows up and down hill yielded 132 bushels while contoured rows yielded 160 bushels per acre. The 1945 growing season was characterized by favorable rainfall and soil moisture conditions. The results show that even in a year of favorable moisture conditions, the additional water held by contouring brought about better growth and yield of each on these crops."

Georgia Contour Peach Orchard - John T. Bregger, Clemson, South Carolina.-"The Harden Brothers' contour peach orchard is the best demonstration of its kind in Georgia. The same owners are planting an 80-acre peach orchard this winter which will be terraced for irrigation as well as for soil and moisture conservation."



Corn Yields on Shattered Subsoil - Dwight D. Smith, Columbia, Missouri.

"Corn yields for 1945 on the subsoil shattered and treated plots were higher than the check yields by 47 percent. Subsoil shattered plots without subsoil fertilization yielded 28 percent higher than the check. Similar yield trends have been secured during each of the last 3 years. For each of these years sweet clover has been plowed under as green manure before the corn. For the first year of the experiment when there was not a crop of sweet clover to plow under before the corn the shattered and treated plot yields equaled the check yields while there was a depressed yield for the shattered plots without fertilizer treatment in the subsoil. Average yields for the 4-year period have been:

Check plots	28.2 bu. per acre
Subsoil shattered plots	30.8 bu. per acre
Subsoil shattered and fertilized	34.8 bu. per acre.

"The yield difference between the check, and the shattered and treated plot is above the 95 percent line of significance. Subsoil shattering and treatment was in the fall of 1941 when the subsoil moisture was below the wilting point. It was accomplished by double plowing to a depth of approximately 18 inches. This caused partial mixing of the subsoil with the surface soil.

Articles in Journal of Agricultural Engineering.-"Publication of Mr. A. W. Zingg! paper entitled, 'Flood Control Aspects of Farm Ponds', has been accepted by the Journal of Agricultural Engineering. This article will appear in the January issue of the Journal.

"Publication of a paper entitled, 'Bluegrass Terrace Outlet Channel Design', by D. D. Smith, has been accepted by the Journal of Agricultural Engineering, and probably will appear in the March issue."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio.-"Corn yields (in bu. per acre) on the mulch-culture plots for 1945 are given below:

	Land treatment (manure)	Sections			Average
		L	M	N	
Plow	None	83.4	77.7	68.7	76.6
	6 ton	75.2	80.7	77.9	78.0
Disk	None	61.9	66.5	67.6	65.3
	6 ton	62.2	65.9	67.5	65.2

"This corn was grown on 5-year old alfalfa timothy sod. All plots received 300 pounds of 2-12-6 fertilizer drilled in the row at planting time. A 12-bushel loss in yield is indicated for disking in the 1945 season. Due to wet conditions during May and June, considerable difficulty was experienced in the preparation of the disked plots. Poorer initial stands and crow damage on the disked plots necessitated considerable replanting. Recovery of grass and alfalfa plants made cultivation difficult and hoeing necessary. Final stands averaged about 14,000 and 13,000 plants per acre on the plowed and disked plots.

"Corn yields for the 3-year period 1943-45 are given in the following table:

	<u>Manure</u>	<u>1943</u>	<u>1944</u>	<u>1945</u>	<u>3-year average</u>
Plow	None	99.2	96.4	76.6	90.7
	6 ton	104.2	86.9	78.0	89.7
Disk	None	102.4	95.9	65.3	87.9
	6 ton	110.4	98.0	65.2	91.2

		Evaporation, in feet	Temperatures			Avg. Rel. hum.	Av. wind velocity	Lincoln, Neb. average daily
1945	USWB : pan : Pond		Max. °F	Min. °F	Mean °F	8 am.-5 pm.	at pan	radiation, in gram-calories
Jan.	---	0.23	56	-1	29	---	---	---
Feb.	---	.21	63	12	31	---	---	---
Mar.	---	.47	80	5	46	---	---	---
Apr.	.39	.37	84	19	47	77	8.7	388
May	.60	.70	82	33	56	70	7.4	460
June	.66	.90	90	42	62	74	5.6	503
July	.86	.83	99	50	74	68	5.0	576
Aug.	.92	.72	98	52	76	65	5.0	469
Sept.	.84	.60	102	31	65	60	6.6	358
Oct.	.51	.41	86	27	54	57	5.9	293
Nov.	---	.25	85	12	41	---	---	---
Dec.	---	.12	61	-10	21	---	---	---
Total	---	5.81	---	---	---	---	---	---
Apr.-Oct.	4.78	4.53	---	---	---	---	---	---



Hydrologic Studies - R. B. Hickok, Lafayette, Indiana.-"A combined snow and rain on December 24, produced runoff from several watersheds, particularly the 'prevailing-practice' corn watersheds. However, the freeze that followed caused icing in most of the flumes and recorder-float wells. Icing affected some of the records making their tabulation very difficult. Similar conditions followed another rain and snow of December 29 and 30. A great deal of time was required in the field removing ice from the measuring and sampling equipment in order to keep them operating.

"The last reports from the contour-field tests were received this month and the data were compiled. There were 27 acceptable tests with corn, fairly well distributed over the State. The average difference was 6.6 bushels per acre higher yield on contoured than up-down hill plots. Considering the entire group as randomized plots, the difference required for significance at the 5 percent level is 7.9 bushels per acre.

"There were five tests with soybeans which indicated no significant difference in yield between contoured and up-down hill seeding.

"Some attention has been given to appraisal of possible needs for research to provide basis for developing the most effective and efficient terracing practice possible on loessial soils in the southwestern part of the State. Estimates of the Regional Projects Planning Division of the Service indicate that approximately 87,000 acres of this land need terracing. Supervisors of the Knox County District in planning their 'Long Time Program' have estimated an eventual investment in terracing in that county alone of approximately \$1,200,000. This work is getting well underway, approximately 200 miles of terraces being completed in that district at the end of this year. With more help and equipment available in the future the program may be expected to develop rapidly. The agricultural importance of the area and the probable size of investment in terracing justify careful scrutiny of available basic information for determining spacing and hydraulic characteristics of terraces specifically adapted to the situation, considering both the particular soil and climatic conditions."

Hydrologic Studies - R. G. White, East Lansing, Michigan.-"For the month of December, precipitation measured 1.11 inches at the cultivated watersheds, 1.33 inches at the wooded watershed, and 1.11 inches at the stubble-mulch plots, as measured by the Standard Weather Bureau type non-recording raingage. The 40-year average for December for East Lansing is 2.03 inches. Runoff for the month measured 0.5916 inch at Watershed 'A' and 0.6321 inch at Watershed 'B'. There was no runoff at the wooded watershed. At the cultivated watersheds, runoff

was produced by rain and melting snow. There was about a 6-inch layer of frost in the ground, so that water could not be taken into the soil to any great extent. Runoff figures for the month are shown in the following table:"

Date	Cultivated watersheds			Wooded watershed	
	Rainfall	Rainfall		Runoff	
		"A"	"B"		
Dec. 25-26	0.52	0.0725	0.1178	0.53	0
Dec. 26-27	.02	.0328	.0056	.04	0
Dec. 29-30-31	.28	.4863	.5087	.31	0
Total for month	1.11	.5916	.6321	1.33	0

Hydrologic Studies - John Lamb, Jr., Ithaca, New York. - "Snowfall was the off-color item for the period; 12.4 inches fell in November and 17 inches during December. The December snowfall produced practically all of the monthly precipitation. This comes next to the maximum snowfall (over a period of 9 yrs.) for November and December when in 1944 a fall of 41.25 inches was recorded. The 9-year average for November is 8.4 inches, and for December 11.0 inches. The average mean temperature for the month was 3 degrees below the 3 previous years, and the degree days below 32 degrees F increased from a 3-year average of 65 to 76.

"The soil was free from frost due to the snow cover. The temperature and precipitation were consistently low. All of these factors contributed to a low surface runoff which consisted mostly of periodic melting of snow.

"Data on individual storms and the many factors that exist during each storm are necessary in the determination of an economic use of conservation practices. Daily, monthly, and seasonal results are, however, available, but due to space limitations, the following results for the past three seasons show a definite trend."

Seasonal precipitation and runoff in percent of precipitation

Water-shed	Winter			Summer			12 months	
	November thru April			May thru October			Winter and summer	
	Years	Precip-itation	Run-off	Year	Precip-itation	Run-off	Precip-itation	Run-off
		Inches	Percent		Inches	Percent	Inches	Percent
Idle land	-	-	-	1942	31.16	29.6	-	-
in weeds	1942-43	18.93	52.0	1943	21.68	18.4	40.61	34.1
(18 acres)	1943-44	12.26	49.3	1944	21.13	18.6	33.39	29.9
	1944-45	16.94	35.0	1945	27.64	22.9	44.58	28.6
Woodland	-	-	-	1942	30.38	19.5	-	-
(18 acres)	1942-43	19.73	64.3	1943	21.96	19.5	41.69	40.7
	1943-44	12.26	55.2	1944	22.81	16.7	35.07	30.1
	1944-45	16.94	50.6	1945	30.84	19.4	47.78	30.4

Average precipitation and runoff, 1942-43, 1943-44, 1944-45

Period	Idle land in weeds, 18 acres			Woodland, 18 acres		
	Precip-itation	Runoff	Runoff	Precip-itation	Runoff	Runoff
	Inches	Inches	Percent	Inches	Inches	Percent
Nov.-Apr.	16.0	7.3	45.6	16.3	9.3	57.0
May-Oct.	23.5	4.7	20.0	25.2	4.7	18.7
12 months	39.5	12.0	30.4	38.4	14.0	36.5

The above table was taken from Mr. Lamb's report.

Hydrologic Studies - H. A. Daniel, Cherokee, Oklahoma.-"The effect of direction of cultivation and terraces on the conservation of runoff water and crop yields in the following table are being measured. Contour cultivation reduced runoff water loss an average of 19 percent. Even though this is an outstanding saving of moisture, observations on the watersheds show that contour cultivation alone is not sufficient to control erosion. During the same period, however, a combination of terraces and contour cultivation conserved 40 percent more water than land cultivated with the slope.



Table 1. Effect of Direction of Cultivation and Terraces on Percentage of Runoff Water and Crop Yields at Cherokee, Oklahoma.<sup>1/</sup>

Direction of cultivation	Grain yield of wheat:		Runoff Water			
	bushels per acre :		Percent :		Aver-: Percent	
	1945	Average 2/	1945	difference	age 2/	difference
With slope	23.2	16.5	17.4		13.1	
Contour	24.6	17.3	12.7	27	10.6	19
Terrace - Contour	24.5	16.6	9.1	49	7.8	40

<sup>1/</sup> For crop year (July 1 to June 30).

<sup>2/</sup> Four years, 1942-45, total inches of precipitation 30.03, 20.28, 20.33, and 34.35, respectively. The average annual rainfall compiled by the Weather Bureau in Cherokee since 1915 is 25.68 inches.

"Although the rainfall for the 1945 crop year was well distributed and over 8.5 inches above normal, terraces and contour cultivation greatly reduced runoff and also increased crop yields. The yield of wheat per acre was increased 1.3 bushels in 1945 and 2.0 bushels in 1944 by terraces and contour cultivation."

Runoff Studies - N. E. Minshall, Madison, Wisconsin.-"Precipitation for Edwardsville for December was 1.83 inches, .46 inch of this amount was in the form of snow on the 12, 13, 17, and 18. A rain of 1.04 inches on the 24th, and temperatures above freezing, gave a total runoff for the month of about 1 inch from the 50-acre pastured watershed. There were no high intensities during this storm. Temperatures varied from a maximum of 64° on the 8th to a minimum of -10° on the 19th."

Runoff Studies - H. K. Rouse, Colorado Springs, Colorado.-"Although complete summaries have not yet been compiled for all projects, certain facts relating to 1945 are now apparent. At the Albuquerque, N. Mex. project, mean precipitation for the entire year was only 4.85 inches as compared with the 74-year average of 8.06 inches at the Albuquerque Weather Bureau. No runoff occurred on any of the three watersheds on this project.

"Precipitation at the Colorado Springs, Colo. project was the greatest in the 8 years of record, exceeding even the 1941 records on three of four watersheds. New records were set for intensities of rainfall for periods of 1 hour but the intensities for 5, 10, and 15 minutes have been exceeded on several previous occasions. New maximum rates of runoff were observed on two of four watersheds and the second highest rates of the 8-year period were observed on two others. On Watershed W-II, the maximum rate of runoff was four times as high as any observed during previous years, while the amount of runoff for this one storm was half as much as the total runoff for all storms during the previous 7 years."

Runoff Studies - T. W. Edminster, Blacksburg, Virginia.-"The major part of the Project Supervisor's time during December was utilized in a further analysis of the data for the proposed Ridges and Valleys Report. Two summary reports of the work have been forwarded to Mr. D. B. Krimgold for criticisms and suggestions. The analysis of these data is progressing nicely; the major portion of the study of rainfall characteristics has been completed; the Blacksburg watershed data are summarized and plotted; a large part of the Southwest Virginia TVA pasture-watershed data are analyzed. Mr. Donald Wallace, District Engineer, United States Geological Survey, Charlottesville, Va. has offered his full cooperation in furnishing data for watersheds up to 50 square miles."

Hydraulic Studies - V. J. Palmer, Stillwater, Oklahoma.-"The vegetal channel testing program was completed and, in addition, a stability-duration experiment was conducted on long, partially dormant Bermuda grass. Only preliminary calculations of the latter have been completed.

"The stability-duration experiment was designed to determine the length of time a good uniform cover of long Bermuda grass would withstand the erosive action of water when flowing at the permissible velocity used in design. A velocity of 8 feet per second was selected as a value commonly used and a series of steady flows conducted through channel U2 having a silt loam soil and a 5 percent bed slope. This channel remained in excellent condition with only about 1/8 inch of soil removed by over 13 hours of flow 1.3 feet deep with a velocity of 8 feet per second. Then a flow with the velocity 1-1/2 times the permissible was used. For 5 continuous hours a flow 1.8 feet deep with a velocity of 11.5 feet per second coursed through the channel. When the water was turned out, the channel was still intact and the soil loss no greater than that for the previous runs. It seems impossible to 'wash out' a good uniform cover of Bermuda grass in any reasonable length of time under vegetal and soil conditions and flows such as these.

"During the experiment just described Manning's  $n$  decreased from a value of .051 to .044, due, most likely, to removal of leaves from the stems by the whipping, beating action of the vegetation in the very turbulent flow. Observations through glass side walls of flow in profile have shown that submerged, bent over, flexible vegetation acts in this manner. It does not lie inert on the channel bed.

"A paper entitled 'Cooperative Studies at the Stillwater Outdoor Hydraulic Laboratory' was prepared for presentation at the Oklahoma Soils and Crops conference to be held in Stillwater February 11-12, 1946. The laboratory facilities and technique of testing are described. A brief preliminary summary of certain results is included. In 'Agricultural Engineering' for December 1945 appears the paper 'A Method for Designing Vegetated Channels' that introduces VR, the product of velocity and

hydraulic radius, as a criterion for selecting Manning's  $n$ . A graphical solution of Manning's formula incorporating a variable  $n$  and this criterion is illustrated.

"The construction of three additional unit channels in Block B was started."

Hydraulic Studies - A. W. Marsh, Corvallis, Oregon.-"Exchangeable bases and pH were determined on the soil samples used in the 300 day percolation trials. While most treatments show about the same sodium content as at the 60-day percolation, the sulfur treatments continue to show a gradual reduction in sodium content. This parallels the trend in the percolation rates as brought out in the October report. The displaced sodium is apparently being replaced by hydrogen for none of the other bases have been affected."

Hydraulic Studies - Stephen J. Mech, Prosser, Washington.-"Tabulation of the results obtained from two trials on furrows 900 feet long with a grade of 2 percent is presented in the table appearing on next page. Flow and soil-loss measurements were taken at station 0+00, (top of the furrow), stations 3+00, 6+00, and 9+00 (bottom end of plot). "They show very vividly that the soil loss as measured at the end of an irrigation furrow is of very little value in indicating soil movement or erosion damage over the furrow as a whole. They also indicate the large magnitude of erosion on the upper section of irrigation furrows even though the size of stream and furrow grade are reduced as low or lower than can be expected in actual practice."

"On December 13, Mr. P. C. McGrew, State Conservationist, Mr. Fred Shlots, Yakima Soil Survey Supervisor, Mr. McKinley Jackson, Yakima District Conservationist, and Mr. Orlo Krauter, Assistant State Conservationist held a meeting at the Irrigation Branch Experiment Station and the report on the similar conference held here in September was reviewed and discussed."

The following were some of the more important conclusions from our project standpoint:

1. Considerable soil movement occurs on 2 percent slopes even with properly adjusted heads of water. In view of this it seems desirable at some future date to study the effect of reducing furrow grades on such relatively flat land to 0.75 or 0.50 percent grade.
2. That much of the soil movement may take place between the upper end and the middle of the run. This would indicate that serious erosion could take place on part of a field and yet not result in any soil movement from the lower end of the run.



Table Showing Soil Loss and Irrigation  
Characteristics of Different Sections of an Irrigation Furrow

Plowed Corn Stubble Land

Section of furrow	Appli- cation Inches	Runoff Inches	Infil- tration Inches	Runoff Percent	Soil loss per furrow Pounds	Application		Runoff		Appli- cation -Runoff In/Hr.
						Duration hours	Rate In/Hr.	Duration hours	Rate In/Hr.	
					April 10, 1945					
0-300	9.77	5.94	3.83	60.8	115.9	12.967	.75	12.367	.48	.30
300-600	5.94	2.02	3.92	34.0	13.1	12.367	.48	9.783	.21	.32
600-900	2.02	.14	1.88	6.9	1.1	9.783	.21	1.967	.07	.19
					April 11, 1945					
0-300	11.44	7.58	3.86	66.2	137.0	13.100	.87	12.967	.58	.29
300-600	7.58	3.91	3.67	51.6	38.1	12.967	.58	11.733	.33	.28
600-900	3.91	.94	2.97	24.0	2.2	11.733	.33	6.200	.15	.25

Table prepared by Stephen J. Mech, Prosser, Washington.

3. That downslope furrow or corrugation irrigation above 2 percent will always result in soil movement in the field. This would lead to the conclusion that on slopes above 2 percent irrigation must be accomplished either by contour furrows or sprinklers. Since contour irrigation is not always feasible because of topography, sprinklers seem to be the only solution for a permanent agriculture for other than sod-forming grasses. Even with pastures, sprinklers are required during the establishment period.

"These conclusions indicate the need for a great deal of additional work on erosion under irrigation. Considerable experimental progress had been made during the last 3 years, but it has only shown how little we know about it and how serious the problem is."

Hydraulic Studies - Vito A. Vanoni, California Institute of Technology, Pasadena, California. - "The model studies of Lower Caney Lake Spillway Plan III were completed. The spillway covered by this particular plan has a crest 120 feet long, circular in plan, having a radius of 240 feet. The structure is 341 feet long, and has a width at the outlet of 50 feet. The contraction from the crest to the outlet section is accomplished by walls on circular curves with radii of 1106 feet. The slope of the spillway is 3 percent. The tests made during this month included studies with a crowned floor designed to cause the water to follow the curved side walls without the normal diamond waves. We were not successful in completely eliminating these waves, but the crowned floor resulted in some improvement in the flow distribution within the structure.

"The model of Wedington Lake Spillway was completed, installed in the basin, and the test work started. The tests completed were with smooth floor and walls, simulating a friction factor of about .01.

"The model of Lake Coffee Mill Spillway Plan IV was completed. A preliminary report covering tests of the existing spillway at Bear Creek Lake and of Plan I were submitted to the Regional Office."

Sedimentation Studies - Carl B. Brown, Washington, D. C. - "At the end of the year the following work had been completed in the investigation being made for the United States Army Engineers on probable rates of silting in the proposed flood-control and multiple-purpose reservoirs in the Central Valley Area of California. Surveys have been completed on six foothill reservoirs and computations have been completed for four of the surveys. Conservation surveys have been made on the watersheds of all six reservoirs and the maps are now waiting planimentering. In the Sacramento Valley above the Iron Canyon Reservoir site, surveys have been completed on Faulke Lake, Misselbeck Reservoir and a survey of Gerber Reservoir was underway. Watershed surveys above these reservoirs are

also underway. This work will be prosecuted vigorously in order to complete a report by February 1 on that phase of the program pertaining to Iron Canyon Reservoir. Plans are being laid for starting surveys on some of the larger reservoirs in the mountain areas in January. Dr. Eldon M. Thorp, who recently returned to duty from service in the Army, was detailed to assist Mr. Glymph in this program at the end of the month."

Sediment Studies - Vito A. Vanoni, Cooperative Laboratory, California Institute of Technology, Pasadena, California.-"The report of the investigation of sediment movement in Pacheco Creek was completed and its reproduction was started.

"Further time was devoted to the study of observations of thermal-density currents made at Shaver Lake. This study is important because it gives information on the amount of the dilution or mixing that occurs between a stream and the lake water into which it underflows. This is one factor that must be clarified in order to be able to predict the total amount of mixing between the stream and the reservoir water which must be known in order to calculate the total amount of the reservoir volume that will be occupied by the density current. Once this volume can be estimated, it is then possible to design outlet works to dispose of the density currents in an orderly and desirable manner."

Drainage Studies - M. H. Gallatin, Homestead, Florida.-"In connection with the irrigation studies on the Rockdale soils, water tables during the month of December for the Rockdale area have dropped on an average of about one foot. Starting in on the south end of Redland Road we had a drop of .7 of a foot. This drop increased to about the center of the area where the drop was 1.18 feet for the month. There was a decrease as the Glades were approached, the last well on Gossman Drive having a drop of .85 of a foot.

"From the rate of drop the leakage through canals must be very high. At the present none of the gates on the canals are in operation. In the lower part of the area across Mowry Drive the water table is only 2.4 feet above mean sea level. If the water table keeps on dropping at the same rate we can expect a rapid intrusion of chlorides.

"Another well has been added to the Mowry Street series. This well was read for the first time on December 31 and is about midway of the marl land between the coast and the higher rock land.

"During the month we have started to set up the rock lysimeters to make preliminary studies of leaching of nutrients. These blocks are being given successive coatings of emulsified asphalt. Each coating is allowed to dry thoroughly so that it will be some time before this work will start.



"The irrigation cycle plats have not been set up as the equipment for measuring moisture has not been received from Washington.

"As soon as the growers start irrigation I will begin checking the various types of systems for distribution. Have talked with the men using the various types and they are very much interested and are willing to let me utilize their equipment to make these checks.

"Samples run this past month in connection with the study of intrusion of chlorides into the marl lands, indicate that chlorides are again building up in the marl lands. Areas that had been washed nearly completely free of chlorides by the rains after the hurricane have gone back up to 3,000-7,000 p.p.m. of chlorides.

"Much of this seems due to excessive pumping of the lower marl area. Many of the fields adjacent to the North Canal and Florida City Canal are showing injury to beans from chlorides. Such crops as tomatoes and potatoes are also beginning to show salt injury. If the weather continues dry at the rate chlorides are now building up, there probably will be a great deal of damage to this area this season.

"It has been reported that many of the wells adjacent to the coast on the marl land are becoming contaminated with chlorides."

Drainage Studies - Ellis G. Diseker, Raleigh, North Carolina.-

"After the completion of a detailed soil survey, by the aid of soil specialist, two areas of the most uniform Bladen silt-loam soil was selected for the drainage experiment. One of the areas is located on the farm of Mr. J. V. Taylor, near Bethel, N. C., and will comprise approximately 55.0 acres for the experiment. The other area is located on the Plymouth Test Farm, near Plymouth, N. C. and comprises 46.6 acres. It was decided to concentrate efforts on the two farms and attempt to get the drainage experiments installed at these points as quickly as possible, and preferably before planting time this spring."

## IRRIGATION DIVISION

Formation of Irrigation Water Balance Sheets for Selected Areas - San Luis Rey Valley, Calif. - Harry F. Blaney reports.-"A final report on the utilization of the lower San Luis Rey Valley, in cooperation with the California State Division of Water Resources, has been completed. This report presents the results of a 5-year study and contains data on irrigation, evapo-transpiration, ground-water fluctuations, evaporation, and precipitation. Estimates are made of consumptive use and the amount of water that might be conserved by salvaging evapo-transpiration losses of riparian vegetation in the valley areas of high water table. Water rights on the San Luis Rey River are rather complicated. In addition to individual enterprises, the following organizations are involved in the use of the waters of the river: The Carlsbad Mutual Water Company, City of Oceanside, Escondido Canal Company, Escondido Mutual Water Company, Fallbrook Public Utility District, Middle San Luis Rey Soil Conservation District, San Diego County Water Company, Upper San Luis Rey Soil Conservation District, Valley Center Soil Conservation District, and Vista Irrigation District. The results of the investigation should be useful in administering water rights and aiding in the solution of problems of water use and conservation in the San Luis Rey Valley and other watersheds of southern California."

Evaporation, Transpiration and Seepage Losses Affecting Irrigation - Arthur A. Young reports.-"Continued search for evaporation records in the Sacramento and San Joaquin Valleys and in the Los Angeles area proceeded unceasingly throughout December and resulted in the finding of data heretofore reposing only in private files of various water organizations. It has been noticeable that the most evaporation data exist in those portions of the state where water for irrigation is high priced because of its scarcity and the least number of records were found where water was plentiful. The type and size of evaporation pans used in obtaining measurements included land and floating pans both circular and square. Floating pans were usually square and were protected by rafts or a boom to diminish wave action and prevent shipping or loss of water in the pan. Land pans were of many sizes ranging from a 5-gallon can to a tank 10 feet square. A majority of land pans were of the standard Class A Weather Bureau type or a square pan set in the earth. Altitudes at which evaporation measurements were recorded varied from below sea level in Imperial Valley to 7,100 feet above sea level but many records were found at low elevations on the Coastal Plain and in the Central Valley of California. The highest rates of evaporation recorded according to data so far tabulated were about 140 inches annually."

Dean C. Muckel reports.-"A final report on the San Luis Rey Investigation has been completed in manuscript. One of the interesting items brought out in this report is that there are approximately 17,816 acre-feet of water being used annually along the valley floor by riparian native vegetation. Of this water it is estimated that 9,200 acre-feet per year is available for salvage and could be put to beneficial use. Based on the average irrigation requirement of 1.50 acre-feet per acre in this area this amount of water could irrigate over 6,000 acres of land."



Dean W. Bloodgood reports.-"At Buchanan Dam, and during November, the evaporation loss from a Bureau of Plant Industry pan was 3.45 inches; from a Weather Bureau pan, 4.69 inches; and from a Division of Irrigation pan, 3.60 inches. The total precipitation for the month amounted to 2.68 inches, all of which fell on the 10th.

"At Mansfield (Marshall Ford) Dam the evaporation loss from a Weather Bureau pan was 4.35 inches and from a Division of Irrigation pan, 3.46 inches. The total precipitation for the month amounted to 1.84 inches, of which 1.26 inches fell on the 10th."

Control of Silting in Irrigation - Dean W. Bloodgood reports.-"Stencils have been cut for mimeographing a report on the 'Silt Load of Texas Streams, Part VI'. This is an annual progress silt report and will contain data for the water year ending September 30, 1944. This report will be mimeographed for general distribution."

Design, Invention and Testing of Irrigation and Drainage Apparatus - R. L. Parshall reports.-"I made a short inspection trip along the North Platte River east of North Platte and was shown a number of irrigation and power canals where the menace of sand deposit in the channels was approaching the point where the filling is materially decreasing the carrying capacity of the canals. One of the limiting factors in the operation of the sand traps along the river would be the head available for sluicing the trapped material back to the river. It is believed, that with the water stage in the canal at full capacity, this difference in head would be sufficient under these conditions to provide ample head for practical operation. Since returning from this trip, the idea has occurred to me that it will be possible to develop a sluiceway where the flowing water will be made to assume a vertical flow and thus carry in suspension the sand load similar to the flow in the vortex tube. I am contemplating building a model covering this idea, this model to be operated in the Hydraulic Laboratory here in Fort Collins."

Pumping for Irrigation - Carl Rohwer reports.-"A paper on the Hydraulics of Water Wells was prepared for presentation at the annual meeting of the American Society of Civil Engineers in New York on January 18, 1946. At the request of the chairman of the Committee on the Economics of Ground Water a synopsis of the paper was also prepared. This paper is a summary of the essential information on the factors that influence the flow of ground water into wells and the formulas showing the relation of these factors to the discharge of wells."

Water-Supply Forecasting - W. T. Frost reports.-"A very promising start has been made toward lining up the support of the State Conservationist and District Conservationists in the snow-survey program. The most active cooperation is now centered in the South Wasco Soil Conservation District where the Board of Supervisors has indicated that they desire several new snow courses and that they will also endeavor to have several key stream-gaging stations installed."



Clyde E. Houston reports active interest among Nevada snow-survey cooperators. The Bureau of Reclamation at Boulder City is interested in the snow-survey program in Arizona. A new snow course, Trough Springs, was established on the west slope of the Charleston Mountains with the aid of C. H. Jamison, State Artesian Well Supervisor at Las Vegas. This course will be used in the artesian study of Pahrump Valley now being conducted by the State and the United States Geological Survey. The equipment and instructions for conducting this season's snow surveys have been sent out and the past snow-cover records and reservoir-storage data for Arizona have been computed.

R. L. Parshall reports.-"During the month plans have been prepared for conducting the snow-survey work for the season of 1946. One new snow course will be added to our total, making about 75 such courses in the State of Colorado. We have in stock all necessary equipment for this coming snow-survey season.

"During the month there has been below average accumulation of snow cover in the high mountains. It is estimated to be practically the same as existed at this time last year. This fact is not alarming at this time, as far as irrigation water supply is concerned, because throughout Wyoming and Colorado, except the San Luis Valley, the carry-over of water in storage is the best in many years, and for the North Platte in Wyoming and Nebraska there is now enough water in storage to meet the irrigation demands for 1946."

Storage of Water Underground for Irrigation - Dean C. Muckel reports.-"The first water available for spreading this season occurred during the last week in December as a result of heavy rains throughout Southern California. On the 27th, 40 second-feet were being diverted from the Santa Ana River to the spreading grounds near Mentone. The capacity of this spreading system is approximately 130 second-feet. At our evaporation station in Santa Ana Canyon, 5.44 inches of rain fell during the storm. In the higher elevations more than double that amount is reported.

"A progress report covering the San Joaquin Valley Joint Investigation water spreading project is now nearing completion. An attempt was made to correlate the rates of percolation as found on small test ponds of 0.01 acre in size with the rates of percolation found on large areas of many acres. The rates on the small test ponds were consistently higher than those on large ponds and the ratio between the two constantly changed as the spreading runs continued. In many cases there did appear to be a definite trend of the ratios. Unfortunately all the necessary data, such as depth of water, condition of the soils, etc., are not available for the larger areas. Records of uninterrupted spreading runs of 360 days on test ponds and 105 days on large areas are available.

"One test pond equipped with a buffer strip had percolation rates conforming more nearly to those on large areas. When the buffer strip was put in operation the rates on the test pond decreased approximately to 25 percent of the original and recovered fully when the buffer strip was dewatered.

"The seepage losses from an irrigation canal with a nominal bottom width of 30 feet was computed for 32,500 feet of canal length. The seepage losses when reduced to acre-feet per day per acre was very nearly the same as the percolation rates found in adjacent large spreading ponds. This particular canal has been in operation many years and is usually cleaned with a dragline every year. The seepage losses varied from a few tenths of a foot to 2.70 feet in depth per day."

Drainage of Irrigated Land - San Fernando Valley, Calif. -

Harry F. Blaney reports.-"A preliminary report on the 'Ground Water Situation in San Fernando Valley' was made at the request of representatives of the San Fernando Valley Soil Conservation District, Los Angeles City Water and Power Department, Los Angeles City Engineer, and the Los Angeles County Flood Control District. The purpose of this report is to summarize readily available information pertaining to the high ground-water situation in the valley, with the view of seeking a solution of the drainage problem existing in certain portions of the San Fernando Valley Soil Conservation District and to outline a program for future investigations. A series of wet years has been the principal contributing factor to high water-table conditions in the valley. It is estimated that during a typical wet year (1943) the contribution to the valley ground-water supply from rainfall penetration, channel percolation, water spreading, and return waters from irrigation and domestic services was 145,400 acre-feet, or 16,900 acre-feet more than the outflow. In years of normal rainfall the input to the ground-water basin would probably balance the outflow, while in dry years the outflow from pumping and rising waters would exceed the recharge."

Rehabilitation of Irrigation and Drainage Enterprises -

Wells A. Hutchins reports completion of his report on the Irrigation organizations in the Price River area in Utah. This is a Case-Wheeler project and the report was made at the request of Operations.

J. H. Maughan reports his special assignment to Operations Region 5 for the purpose of re-examination and revision of the Case-Wheeler project reports in light of peace-time conditions. A field trip was made over the projects and the office studies were made at Lincoln, Nebraska. Mr. Maughan states ---"One of the principal problems is to determine the probable ability of farmers to pay project costs during times of peace.

"As originally reported, the ability to pay on all projects, was figured by means of a typical farm-unit analysis. By this method the estimated production, costs, and returns for an assumed typical farm were analyzed. The net income was assumed to represent the amount available for the payment of water costs.

"One question in the re-examination of reports relates to the long range ability to pay. Do the basic data used in the economic analysis conform to the probable peace-time conditions?

"Another question relates to the adequacy of the analysis of a typical farm unit as the basis of determining and reporting productivity on the project. An alternative method under consideration is by means of the farm-operator and farm-owner shares of the crop production. Under this analysis the farm operator's share pays the usual costs of production including the family living. Thus the landowner's share is available to pay the landowner's costs, including costs of the project. One advantage of this analysis is its simplicity as a means of presentation. It is simple and easily understood.

"In preparing reports on the projects under consideration, it seems well to make the basic economic analysis by both of these methods with frequent checking back to actual farm conditions. This will provide a check on the results obtained.

"There is evident need of a comprehensive study to be made of the costs and value of irrigation water, including the benefits of farm-irrigation improvements. Analysis on the basis of assumed conditions, for typical farms and for projects, are helpful but it seems evident that extensive study should be made of crop production, costs, and returns under actual farming practice. This would provide a more acceptable guide in considering the value of water and of irrigation improvements."

Research Assistance to Operations - Fred C. Scobey reports assistance to Operations in connection with Elicuera Creek Reservoir, Napa County, Calif. It appears that 40,000 to 50,000 acre-feet of storage can be developed with a dam 125 feet high. The project looks promising for the development of 10,000 to 15,000 acres of excellent land.